DITTMAR'S CHEMICAL ANALYSIS

A Manual of Qualitative Chemical Analysis. By William Dittmar, Professor of Chemistry in Anderson's University, Glasgow. (Edinburgh: Edmonston and Douglas, 1876.)

WITH the numerous works on chemical analysis already in existence we are justified in asking what special advantages Prof. Dittmar has to offer to chemical students in bringing out another book on the same subject. It will be found, in answer to this question, that the present work contrasts favourably with many of our standard books on the subject both as regards completeness, originality of treatment, and the introduction of a large amount of important matter which has not hitherto found its way into our manuals of analysis.

In giving our readers a brief sketch of Prof. Dittmar's mode of treatment, we shall point out what appear to us to be the special features in the new analysis deserving commendation.

To quote from the "Introduction":—"The book is intended for the use of students who, after they have mastered the first rudiments of chemistry, enter a laboratory to work *under the direction of a teacher*, while, at the same time, they *continue their study of theoretical chemistry*."

Following the Introduction, we have a series of exercises calculated to make the student practically acquainted with most of the operations and processes employed in analysis. Among the readable matter interspersed between the exercises, we notice with satisfaction a clear elucidation of the meaning of the term *equivalent*—a term which appears to have dropped out of most of the modern text-books, leading students to believe (we speak from actual experience) either that the idea is altogether obsolete or is covered in some mysterious way by the word "atomicity."

We are of opinion that the meaning of "equivalent," or "equivalent weight" of an element, should be laid before all students of the science and the relationship of these numbers to the "atomic weights" clearly pointed out. In this same portion of the book will be found also an excellent exposition of the general theory of double decomposition.

The next division treats of the metals, these being divided into six groups, viz., the copper group, comprising silver, mercury, lead, copper, bismuth, cadmium (and palladium); the arsenic group, comprising this metal, antimony, tin (molybdenum, tungsten, gold, platinum, and the platinum metals other than palladium); the iron group comprising chromium, aluminium, iron (uranium), cobalt, nickel, manganese, zinc (thallium), &c.; the barium group comprising this metal, strontium, and calcium; the magnesium group consisting of this metal and lithium; and the potassium group comprising sodium, potassium (rubidium and cæsium). The method here adopted does not much differ from that in general use, excepting that the groups are considered in the same order as that followed in the systematic course of analysis instead of in the inverse order. After the reactions of each of the metals in the group have been considered, their separation from each other and from the other groups is entered upon. We are glad to see that in many cases the author does not limit himself to one particular method of separation, but gives the most effective methods known, and points out under what particular conditions each process is applicable. The reactions of the rarer metals are given in appendices to the main groups. We observe also that Bunsen's flame reactions are sometimes resorted to, this being, so far as we know, the first work since the last edition of the English translation of Fresenius' "Qualitative Analysis," in which these valuable film-tests are introduced to the notice of students in this country. This portion of the book concludes with a general scheme to be followed in performing a systematic analytical search for metals.

The third division of the work treats of the non-metallic elements. In each case the properties of the free element are first considered, then its reactions and the reactions of its acid compounds, and finally the discrimination of the element and its acid compounds in complex mixtures. The order in which the various groups are treated of is as follows:—The halogens, sulphur, selenium, and tellurium, nitrogen, phosphorus, boron, silicon, fluorine, carbon, hydrogen, and oxygen. This list of course gives no idea of the complete manner in which the author has treated the subject. That our readers may form a more just estimate of the contents of the work, we propose to point out a few selected details. Thus the chapter on the halogens includes a description of the oxygen acids of these elements and the organic halogenides; under the sulphur group we have, in addition to the reactions of the sulphides, sulphites, and sulphates, a discussion of the characters of the dithionates, polythionates, and organic sulphur compounds; under nitrogen we find ammonia, the oxides and acids, and organic nitrogen compounds (ammonium compounds are treated of as an appendix to the potassium group of metals); the acids of phosphorus are considered in great detail, and a section devoted to organic phosphorus compounds. The chapter on carbon includes the analytical characters of a large number of organic bodies, *e.g.*, cyanogen and its compounds, the fatty acids, the acids of the lactic and oxalic series; also a section on the ultimate analysis of carbon compounds. Under hydrogen the author treats of water, and under oxygen we find remarks on ozone, hydrogen peroxide, and a very complete section on the detection of this element in a combined state. This division concludes with a "Summary of operations available for the detection of the *non-metallic* constituents of substance in general, and of the *inorganic acids* in a mixture of metallic salts in particular."

Having mastered the analytical reactions of the metals and non-metals the student is, in the concluding division of the work, introduced to the analysis of substances of unknown composition. The preliminary chemical examination is conducted in the usual manner—some of the substance is first heated *per se*, then in a current of air, with "bisulphate of potash," with soda-lime, a mixture of caustic soda, nitre, &c. Then follows an account of the well-known flame and blowpipe reactions and of Bunsen's "film tests." The preliminary examination in the wet way is next undertaken, and this is followed by a section on "methods of disintegration for some of the more frequently occurring classes of substances." With regard to the exhaustive analysis of complex mixtures,

the author contents himself with a few general remarks, leaving it to the student to apply the methods acquired in working through the foregoing portions of the book, instead of guiding him, or, we should rather say, binding him down to the usual "tables."

It would be invidious on our part to institute comparisons between the present and any existing work on the same subject; but, considering the volume as the expression of the method taught by Prof. Dittmar, we are of opinion that it stands on a decidedly higher level than the generality of such works.

Although the author's accuracy is throughout unimpeachable, there are some few questionable, or at least debateable points, which demand a passing notice.

In the first place, we regret to see the occasional appearance of what we must consider badly-constructed phrases such as the following (p. 44):—"To students who have not yet got far enough advanced to invent their own methods." Then, again, we hardly know whether to admire or to condemn the frequent inconsistencies of formulation. To give a few examples:—Phosphoric acid is written in different parts of the book in no less than four different ways: thus, at p. 11, $HHHPO_4$; p. 253, $PO(OH)_3$; p. 244, $P_2O_5 . 3H_2O = 2PH_3O_4$; at pp. 244-245, the metallic phosphates are written $PO_4HR'_2$, PO_4H_2R', and $PO_4R'_3$, and on the same page metaphosphoric acid is written HPO_3. Then on the same page (41) we find two nitrates thus formulated: $HgON_2O_5$ and $Bi(NO_3)_3$. Now, although we admire the spirit which leads a writer to adopt these different modes of formulation as being a spirit of independence, which in the *original worker* shows that he is not the slave of any hypothesis, we think that the case is entirely altered when we have to deal with *students* of the science, nothing shaking the faith of a learner so much as an apparent want of consistency.

We cannot conceive why the author has gone back to the old nomenclature—"nitrate of potash," "bisulphate of potash," "phosphate of soda," &c. Although consistency is displayed throughout the book in this matter we cannot sanction the use of a system of nomenclature which, if not entirely obsolete, is rapidly becoming so among the scientific chemists in this country. Be it understood that our protest is here again entered solely from a student's point of view. It must perplex the learner to find out that the substances he has been employing in Prof. Dittmar's laboratory under the names of "bisulphate of potash," "phosphate of soda," &c., are known elsewhere as "potassic disulphate," "hydric potassic sulphate," or "hydrogen potassium sulphate," "hydric disodic phosphate," or "hydrogen disodium phosphate," &c.

With these remarks we may conclude our notice of what we venture to look upon as a valuable addition to our literature of the important subject of chemical analysis. We are confident that Prof. Dittmar's work will stand, by virtue of its own merits, as a scheme for instructing in this branch of the science.

We have in these columns (vol. xi. p. 107) formerly expressed the opinion that the systems of analysis in general use in our schools of chemistry need reforming in certain particulars. Thus in the article referred to we found occasion to complain of the want of chemical science displayed by the majority of students practising analysis according to certain cut and dried systems of "tables." It must be conceded that the student who is thoroughly well grounded in the *scientific principles* involved in chemical analysis must take a higher position than he who works blindly from a given set of rules. That some such idea is entertained by the author of the present work is shown by the fact that the three first divisions of the book are considered enough to furnish a sufficient groundwork of scientific principles to enable the use of tables to be dispensed with altogether when the analysis of complex mixtures presents itself so that both teachers and students may now congratulate themselves on possessing a work in which a step has been taken in the right direction—a system which brings into exercise the thought, knowledge, and judgment of the analyst, instead of leaving him a mere helpless machine forced to proceed in the fixed direction laid down in this or that set of "tables." R. M.

RICHARDSON'S "DISEASES OF MODERN LIFE"

Induced Diseases of Modern Life. By B. W. Richardson, M.D., M.A., F.R.S. 8vo. Pp. 520. (London: Macmillan and Co., 1876.)

HEALTH is proverbially one of the greatest blessings man can enjoy, and yet in this hardworking, hurrying, struggling age, many a one deliberately sacrifices it in the endeavour to succeed in his pursuits, commercial, literary, or scientific. Success is the object of their desires, and they are quite willing to pay for it the price of broken health and shortened life. This is even more the case with literary and scientific than with commercial men, for the latter generally look forward to several years of retirement and ease as a reward for their labours, while the former are rather anxious that their work itself shall be such as to secure them a certain place among the world's great ones, than concerned whether their fame be posthumous or not. In struggling to accomplish it they too often forget that "the race is not to the swift," but rather to the long enduring, and that if Cuvier or Darwin had died before reaching middle age, not only would their names have remained comparatively unknown, but science would have sustained an irreparable loss. Sometimes the worn-out body reminds them only too forcibly of the dependence of the mind upon it, work becomes impossible, every occupation must be renounced for a time, and the vantage ground which has been gained by unremitting toil is entirely lost. Nay more, the exhausted energies require a long time to recover; when work is resumed it can rarely be carried on with the same vigour as before, and meanwhile some slower but steadier competitor steps in front and wins the longed-for prize, or makes the eagerly-desired discovery. Several years ago we began to ascend the long flights of steps which lead to the higher part of the island of Capri, at the same time with another party. They ran briskly up while we went slowly on, and they reached the top of the first flight while we were only half way up. But here they were out of breath and stopped to rest. We, on the contrary, never stopped; if breath began to fail we went more slowly, but we never stood still. The consequence was that we passed the other party about the middle of the second flight, and